Coefficient of kinetic and static friction

SPH4U Lab # 4

Procedure:

- Get a plank, a spring scale, a piece of rope and a piece of wood from the front of the class.
- Record the mass of the object.

Part A

- Lie the plank flat on the table.
- Attach the rope to the piece of wood.
- With the string held parallel to the level board, pull the object along the board at a constant speed. With the spring scale, measure the amount of force required to just keep the object moving at a uniform rate. Repeat the procedure 5 times so that you may take an average of the value later.
- Record your results in a table which includes the weight of the object (in N) and the force of sliding friction (in N).

Part B

- Detach the spring and rope from the piece of wood and place the piece of wood on the plank.
- Slowly lift one end of the plank until the piece of wood just starts to move. Use a protractor to measure this angle.
- Repeat this several times and generate a table

Part C

- Move the piece of wood to one end of the plank. Slowly lift the end of the board while your partner lightly taps the object. Adjust the angle of the board until the object slides at a constant speed after it has received an initial light tap. Use the protractor to measure this angle and record it in a third table.

Analysis:

- From the data in table 1 calculate the coefficient of sliding friction (remembering that $u_k=F_F/F_N$ and you have both the force of friction (measured) and the normal force (able to calculate)
- From the data in table two, calculate the coefficient of static friction (remember the link between angle of inclination and the coefficient of friction).
- From the data in table three calculate the coefficient of sliding (kinetic) friction.
- Explain the difference between the values for the coefficients of static and kinetic friction.
- Are your values for the coefficient of sliding friction from tables 1 and 3 equal? Explain any differences.

COEFFICIENT OF KINETIC FRICTION

1. A 20.0 kg box is pulled across a level floor, where the coefficient of kinetic friction is 0.30. What horizontal force is required for an acceleration of 1.5 m/s^2? *[89N]*

2. A 50.0 kg crate is pulled across a level floor with a force of 200.0N. If the force acts at an angle of 30 degrees from the horizontal, and the coefficient of friction is 0.30, determine:

a) the normal force exerted on the crate by the floor. *[390N]*
b) The horizontal frictional force exerted on the crate by the floor. *[117 N]*
c) The acceleration of the crate. *[1.12 m/s^2]*

3. A skier skiing downhill reaches the bottom of a hollow with a velocity of 15 m/s and then coasts up a hill with a 15 degree slope. If the coefficient of friction is 0.10, how far up the slope will she travel before she stops? *[32m]*

4. A wooden block sits on a plank. The coefficient of kinetic friction between the two surfaces is 0.30. Determine the angle from the horizontal at which the plank can be held such that the wooden block slides down the plank at a uniform speed. *[16.7']*

5. A set of boxes is being pushed across the floor by a custodian. If the custodian pushes with a force of 123 N at an angle of 31 degrees down from the horizontal, the boxes have a total mass of 29 kg and the coefficient of kinetic friction is 0.23; a) what is the acceleration of the boxes? What is the speed of the boxes 2.4 seconds after they start from rest? *[$a = 0.88\ m/s^2$; $v = 5.1\ m/s$]*